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BUKAKA CLUSTER EXAMINATIONS

MARKING SCHEME

END OF TERM 1 2025

PHYSICS PAPER 3

FORM 4

QUESTION ONE

You are provided with the following apparatus:

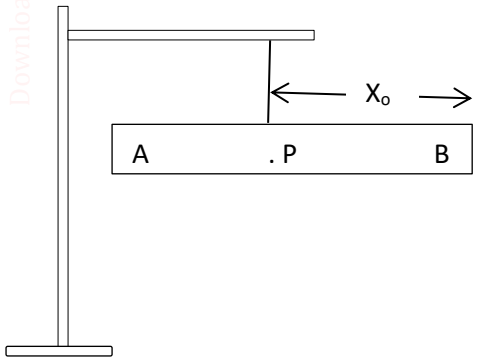
- Metre rule marked A and B.
- Retort stand, clamp and boss.
- Two pieces of thread 30cm long each.
- Mass M of 50g.
- Rubber bands, 10 pieces tied with a string, of mass Q.
- Glass block.
- Soft boards.
- Plain papers.
- Four optical pins.
- Four thumb tacks.
- A protractor.

PART A

Proceed as follows:

a) Balance the metre rule provided by hanging it on a stand using one of the threads provided.

b) Note the position **P** of the thread where the metre rule balances and record the distance $\mathbf{X_o}$ from end B of the metre rule.

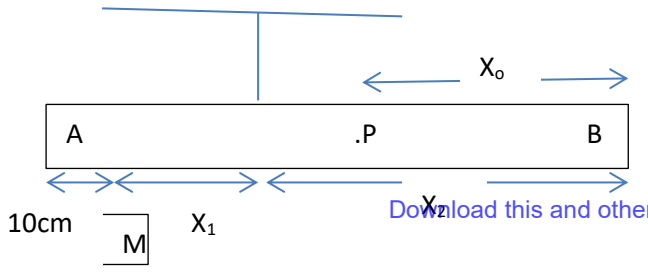


X_o = 49.9 ± 0.2cm

- ✓ *1d.p a must.*
- ✓ *Units a must. Missing units deny ½ mk*

(1mk)

c) Place a mass M of 50g at the 10cm mark from end A and adjust the position of the thread until the metre rule balances again as shown.



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d) Measure and record the distances X_1 and X_2.

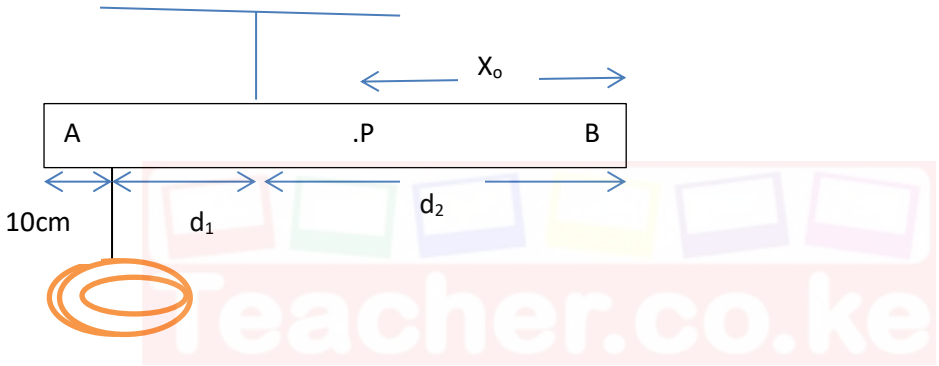
X_1 = 27.9 ± 0.2 cm 1 d.p is a must (1/2 mk)

X_2 = 62.1 ± 0.2 cm 1 d.p is a must (1/2 mk)

e) Calculate the value of W, weight of the metre rule from the expression $W = \frac{50X1}{X2-X1}$. (2mks)

- ✓ *Correct substitution of student's answer. 1mk*
- ✓ *Correct evaluation. Exact answer or 4 s.f 1mk*

f) Remove the mass M and replace it with the rubber bands of mass Q provided. Adjust the metre rule again until it balances as shown.



g) Measure and record the distance d1 and d2.

d_1 = 38.5 ± 0.2 cm 1 d.p is a must (1/2 mk)

d_2 = 51.5 ± 0.2 cm 1 d.p is a must (1/2 mk)

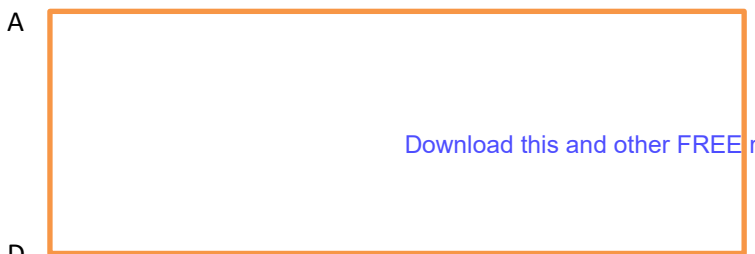
h) Calculate the weight Q of the rubber bands using the expression $Q = \frac{w(d2-d1)}{d2}$. (2mks)

- ✓ *Correct substitution of student's answer. 1mk*
- ✓ *Correct evaluation. Exact answer or 4 s.f 1mk*

PART B

Proceed as follows:

a. Fix the plain paper on the sot board using the thumb tacks.
b. Place the glass block on the paper fixed. The glass block should rest on the paper from the broader face.
c. Trace the glass block using a pencil. Remove the glass block and label its edges as A, B, C and D as shown below.



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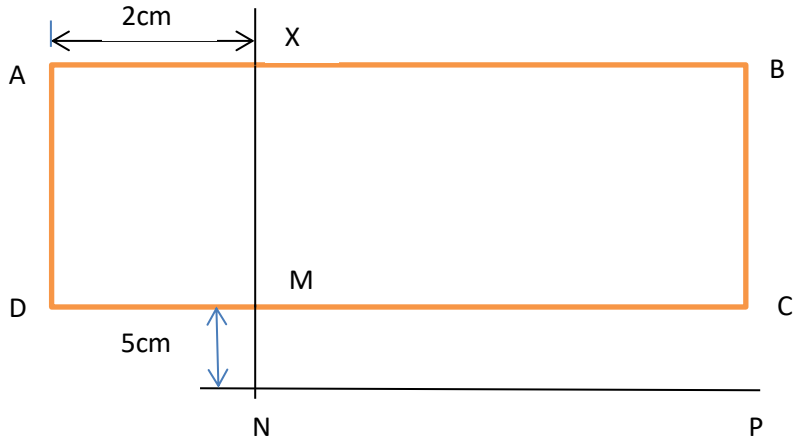
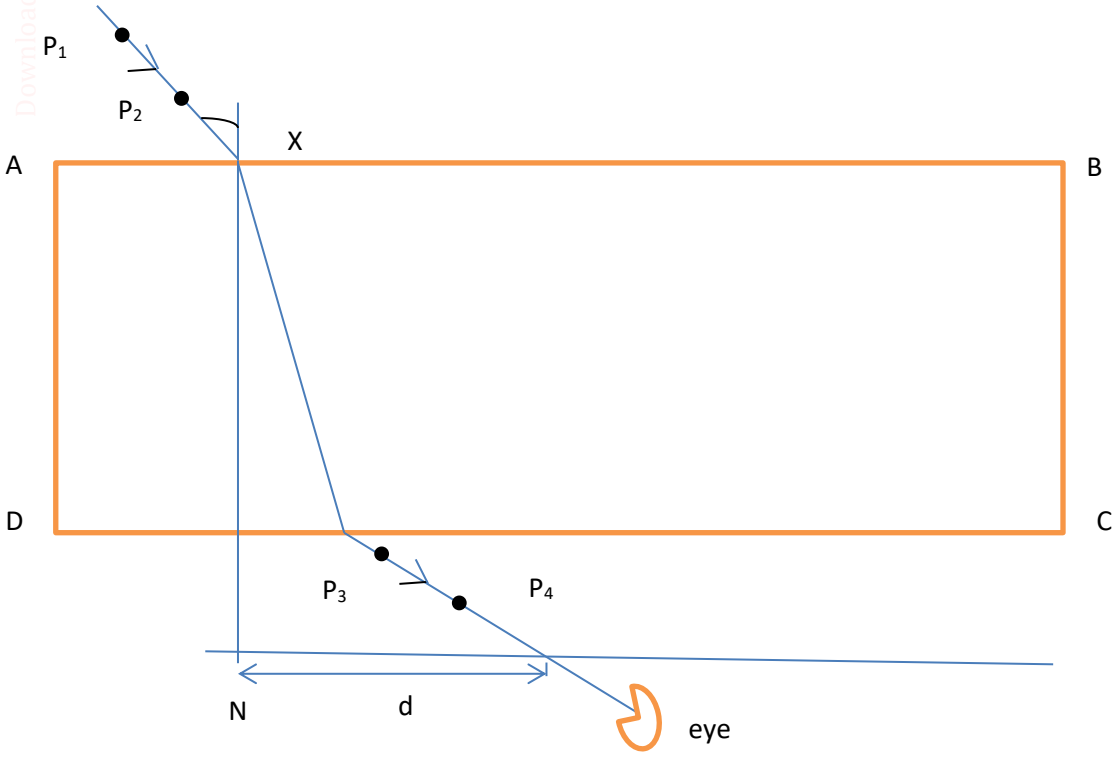
d. Mark point X on one of the longer sides of the traced glass block such that point X should be 2cm from edge. Construct a normal at X to emerge through the DC at point M.
e. Mark point N along the emergent normal at 5cm from M.
f. Construct line NP to meet the normal at N at 90°. Line NP should be 10cm.



g. Using a protractor, construct an incident ray RX at an angle of incidence, i = 10°. Fix two pins P_1 and P_2 along RX.
h. Replace the glass block to the traced figure. View the path of incident ray RX through the glass block using the other pins P_3 and P_4.
i. Remove the glass block and draw the emergent ray through P_3 and P_4.
j. Measure the distance, d, of the emergent ray from point N along line NP as shown below.



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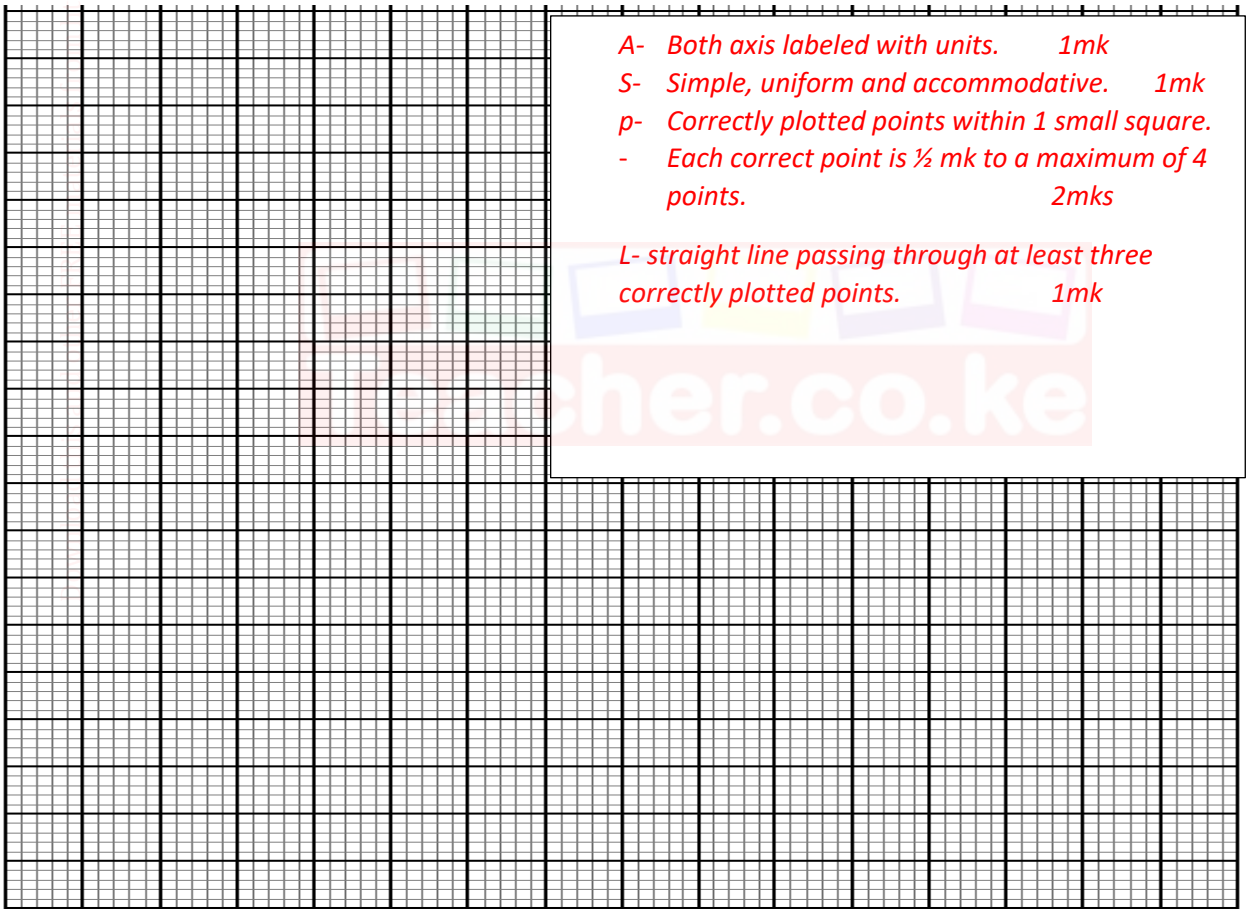
NOTE: The plain paper should be submitted together with the question paper.

k. Record the corresponding values of d in the table below. Repeat the procedure for other values of i°. (5mks)

Angle of incidence, i°	10	20	30	40	50	
Distance, d (cm)	*1.8*	*4.0*	*5.5*	*8.6*	*9.4*	✓ *± 0.2* ✓ *1 d.p a must* ✓ *Each correct value is 1mk to a maximum of 3mks*
Sin i°	✓ *Correct conversion of students answer.* ✓ *Exact answer or 4 s.f* ✓ *In each column, all correct values 1mk*					
Sin 2i°						

l. Plot a graph of sin 2i (vertical axis) against d. (5mks)



A- Both axis labeled with units. 1mk
S- Simple, uniform and accommodative. 1mk
p- Correctly plotted points within 1 small square.
- Each correct point is ½ mk to a maximum of 4 points. 2mks

L- straight line passing through at least three correctly plotted points. 1mk

m. Calculate the gradient of the graph. (3mks)

✓ *Change in y ½ mk*
✓ *Change in x ½ mk*
✓ *Correct substitution 1mk*
✓ *Correct evaluation, exact answer or 4 s.f 1mk*

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QUESTION TWO

You are provided with the following:

- A retort stand, clamp and boss.
- A spiral spring.
- A stop watch.
- A 50g mass.
- A 100g mass.
- A metre rule.
- A voltmeter.
- An ammeter.
- A resistance wire labeled W mounted on a half metre rule.
- A resistance wire labeled Q mounted on a half metre rule.
- A micrometer screw gauge.
- Seven connecting wires.
- Two new dry cells.

PART ONE

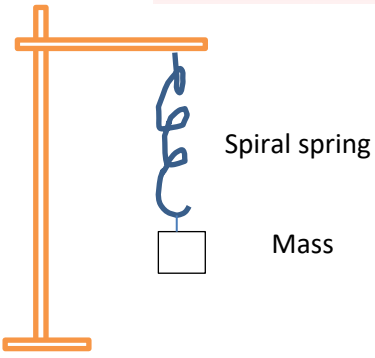
Proceed as follow:

a) Determine the length, L, of the spiral part spring using the metre rule.

L_1 = depends on the spring provided cm 1 d.p is a must *(1 mk)*

L_2 = correct conversion to 3 d.p m *(1 mk)*

b) Suspend a 50g mass at the end of the spring as shown below.



c) Now give the mass a small vertical displacement and release so that it performs vertical oscillations. Time ten oscillations and determine the periodic time, T. Enter the results in the table below.

d) Repeat the experiment for the other values of mass and complete the table. (4mks)

Mass, m, (g)	50	100	150	
Time for 10 oscillations, t, (s)	*4.34*	*6.16*	*7.69*	✓ *± 1.0* ✓ *2 d.p a must* ✓ *@ correct value is 1 mk to a maximum of 2mks*
Periodic table, T, (s)	*Correct conversion.*			✓ *@ correct value is ½ mk to a maximum of 1mk*
T^2 (s^2)				✓ *All correct 1mk.*

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	Exact answer or 4 s.f	

e) Given that; T = $\pi\sqrt{(\frac{m}{k})}$ where k is the spring constant. Find the average value k for the spring. (3mks)

✓ *Correct determination of k in each case. 1½ mk*
✓ *Principal of averaging of k ½ mk*
✓ *Correct evaluation 1mk*

PART TWO

Proceed as follows:

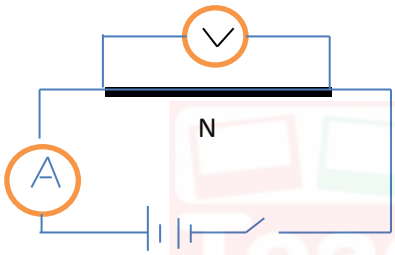
a. Using the micrometer screw gauge provided, measure the diameter, d, of the wire labeled Q.

d = 0.37 ± 0.02 mm 2 d.p is a must (1mk)

b. Determine the radius, r, of the wire.

r = correct division of student's d by two, mm at least 2 d.p (1mk)

c. Set up the apparatus as shown below.



i. Record the voltmeter, V, and ammeter, I, reading.

V = 1.6 V ± 0.2

✓ *1d.p a must.*
✓ *Units a must. Missing units deny ½ mk*

(1mk)

I = 0.08 A ± 0.02

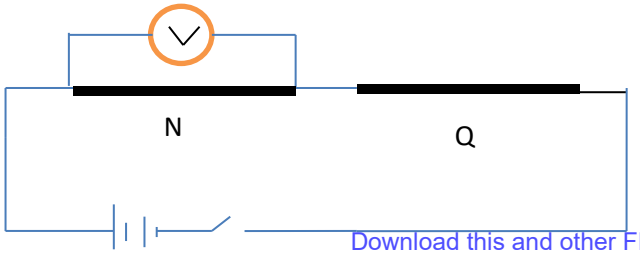
✓ *2d.p a must.*
✓ *Units a must. Missing units deny ½ mk*

(1mk)

ii. Determine the resistance, R_N of the wire N. (2mks)

✓ *Correct substitution of V_N/I_N of student's answer. 1mk*
✓ *Correct evaluation, exact answer or 4 s.f. 1mk*

d. Set up the apparatus as shown below.



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e. Use the voltmeter provided to measure potential difference, V_N across wire N and V_Q across wire Q when the switch is closed.

V_N = 1.6 ± 0.2 V 1 d.p a must (1/2 mk)

V_Q = 0.6 ± 0.2 V 1 d.p a must (1/2 mk)

f. Use the value of R_N calculated in C. ii above and the value of V_N to calculate the current, I, flowing through wire N when switch was closed. (2mks)

- ✓ *Correct substitution of V_N/R_N of student's answer. 1mk*
- ✓ *Correct evaluation, exact answer or 4 s.f. 1mk*

g. Determine the constant, L, given that; $L = \frac{RN}{VQ}$. (2 mks)

- ✓ *Correct substitution of V_N/I_N of student's answer. 1mk*
- ✓ *Correct evaluation, exact answer or 4 s.f. in A^{-1} 1mk*

Missing units deny ½ mk
Wrong units deny 1 mk

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